PinPoint allows seismic to go lineless.

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If you live in western Canada chances are you've seen a seismic line. Narrow corridors cut through the bush, seismic lines facilitate access for people and equipment to conduct geophysical surveys to interpret subsurface attributes important for oil and gas production.

Once cut with bulldozers as 6-8 m wide, flat work surfaces, conventional (i.e. legacy) lines impact myriad birds and mammals. Creation of those flat work surfaces removed aboveground vegetation, roots, and soil. In doing so, conventional lines altered basic ecosystem processes that stalled expected recovery trajectories and established different vegetation communities preventing recovery to pre-disturbance states and perpetuating impacts to animals, especially in wet landcover types like bogs, fens, marshes, and swamps. Since the mid-1990s, efforts to mitigate impacts have focused on preparing narrower low-impact seismic (LIS) lines that remove only aboveground vegetation. Now routinely cut to between ~ 1.75 and 2.75 m wide using mulchers, LIS is considered standard practice across most jurisdictions in Canada. However, LIS mitigations are not 100% effective. Only the narrowest LIS lines seem to prevent impacts to animals and there is considerable individual variation in species' response. Vegetation appears to recover more quickly along LIS lines, but that trajectory is complex and depends on line orientation and width.

If the impacts to plants and animals of preparing seismic lines is difficult to mitigate, perhaps the best thing to do is to stop preparing seismic lines.

The principles of seismic are straightforward: introduce an energy source into the ground using vibrations or explosive detonations and measure the reflected or refracted energy using a sensitive recording device called a seismic receiver. Sources and receivers can roughly be thought of as raw data points on a seismic survey. More sources and receivers deployed at a higher density translates to higher data quality and a better ability to accurately interpret nuanced subsurface attributes. Math and physics explain that many more smaller sources better identify signal from noise than fewer larger sources because repeated samples are more important than "big" samples – the same concept used by astrophysicists to image distant objects.

This is important for seismic data, seismic lines, and boreal conservation because seismic lines need only be as wide as the widest piece of equipment required to conduct seismic surveys. Concomitant with a narrowing of seismic lines was a shrinking of the required equipment. If a source is small enough to be hand-transportable (receivers have long been hand-transportable), in theory it is possible to conduct seismic surveys without the need for seismic lines at all.

Since 2013, Explor has been working to bring this from concept to reality and recently accomplished this goal in the Athabasca oil sands region in northeastern Alberta by conducting a small 3D survey without preparing a single seismic line, LIS or otherwise, or cutting a single stem of vegetation using PinPoint. PinPoint is a method of data acquisition that amalgamates a series of previously compartmentalized steps to facilitate data collection using only handheld equipment. In this survey, data were acquired at an order of magnitude greater density than

even the most densely sampled in situ seismic surveys in the region. Data are being processed now, but early indications are of superb data quality.

Figure 1:
Where we're going we don't need lines. Explor crew collects seismic data in NE Alberta peatlands without seismic lines.

Figure 2:
Like many field scientists before them, PinPointers are collecting seismic data off-trail. Rapidly advancing technologies and computing power make it feasible to collect seismic data without cutting seismic lines.

While safely collecting field data off-trail is routine for ecological field studies, doing so for seismic operations or in upstream oil and gas generally, is novel. The ecological benefits of going "lineless" are hard to overstate. Seismic lines are a seemingly intractable conservation challenge in western Canada and current LIS mitigation methods are not entirely successful. In situ operations alone account for seismic lines as almost 50% of development's total disturbance footprint. At the intersection of math, physics, and ecology, PinPoint can all but eliminate that footprint and associated ecological impacts.

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